Addressing Late-Season Grape Berry Moth Damage.

Project Leader(s):
Tim Weigle[1], Greg English-Loeb[2,] and Michael Hoffmann[1]
[1]NYS IPM Program and [2]Department of Entomology, Cornell University

Cooperators:
Andrew Muza, Lake Erie Regional Grape Program, Penn State Cooperative Extension
Barry Shaffer, Lake Erie Regional Grape Program, Cornell Cooperative Extension

Funding:
Viticulture Consortium and New York Wine & Grape Foundation

Project Location(s): This research project was located in the Lake Erie grape-growing region of New York and Pennsylvania.

Objectives:
1. Evaluate the use of *Trichogramma ostriniae* for grape berry moth management.
2. Determine the economic loss potential from grape berry moth.

Procedures:
Objective 1: Evaluate the use of *Trichogramma ostriniae* for grape berry moth management.

Twelve vineyards with a history of grape berry moth damage were used for the valuation of *Trichogramma ostriniae* as an egg parasitoid of grape berry moth, twice the number used in 2003. Each vineyard was divided into two blocks; one block at ten of the sites had 5 weekly releases of *T. ostriniae*, starting on July 19 and ending on August 16, while the other block was the control and was to be managed by the grower using the Grape Berry Moth Risk Assessment Protocol for scouting and timing of insecticide applications. The remaining two treatment blocks received only early season applications of *T. ostriniae* timed one week apart on June 17 and 24 to determine if early releases had the ability to build the population of parasitoids to levels needed during the second and third Grape Berry Moth Generations. Due to the reported distribution abilities of this parasitic wasp, blocks within a vineyard were separated by a minimum of 20 rows with only the interior rows of the control used for data collection. Row orientation (parallel or perpendicular to the wooded edge) was taken into account for application of insecticides with vineyards having rows running perpendicular to the wooded edge receiving insecticide to all rows while the vineyard with rows parallel to the wooded edge receiving an insecticide applied only to the outer 6 rows. Releases of *T. ostriniae* were made in a staggered pattern alternating between the second and fifth vines every six to seven rows for those blocks with perpendicular rows and alternating between the middle vine of every third post length on the outside row and the fourth row in from the edge for those rows running parallel to the wooded edge.

Three vineyard blocks treated with T. ostriniae in 2003 received no additional treatments and were used to determine the over wintering potential for this parasitoid in the Lake Erie Region. Native parasitism was examined using three vineyard blocks that have never been involved with any type of project involving Trichogramma.

Mike Hoffmann's lab, Department of Entomology, Cornell University, provided the *T. ostriniae* for this project. Shipments of *T. ostriniae* were shipped overnight via FedEx to ensure

maximum survivability. Release cones used for deploying *T. ostriniae* were similar to those used in 2003.

Each pair of vineyard blocks were scouted more intensively than called for by the Grape Berry Moth Risk Assessment Protocol to ensure that grape berry moth populations did not reach devastating levels. Clusters in each vineyard block were examined for grape berry moth damage and evidence of parasitism of grape berry moth eggs in the field. Destructive sampling consisting of 25 clusters from each block started the week of September 16 (Elvira and Niagara blocks) and continued until mid October. Five clusters were selected from the outermost vine in each of 5 rows. In the treated blocks, clusters were taken from the rows containing the *T. ostriniae* release cones. Samples in the control block mimicked the treated blocks with clusters being selected from vines from every 6th row.

During September and October, parasitized grape berry moth eggs from the treated and control blocks in North East were sent to Mike Hoffmann's lab for evaluation and possible identification of the egg parasites.

Objective 2. Determine the economic loss potential from grape berry moth.

Monitoring of fourteen vineyard blocks, which were classified as being at high risk for grape berry moth infestation, was conducted during the bloom period (direct feeding on the florets), third week of July (ovipositioning stings), third week in August (berry loss due to GBM larval feeding and ovipositioning) and immediately preharvest. As previously mentioned, with the exception of vineyard blocks that we have begun to classify as extremely high risk, grape berry moth damage was not nearly the problem as in recent years.

During the immediate preharvest period 110 clusters were collected for each of three replications at each site. Each replication consisted of 10 clusters collected at row 1, 3, 5, 7, 9 11 and 13 from the wooded edge if rows ran parallel to the woods and where rows ran perpendicular to the woods clusters were collected from vines 1, 3, 5, 7, 9 and 11 from the wooded edge. These clusters were examined for grape berry moth damage, sorted to compare GBM damaged berries from the others in the cluster, and weighed to determine percent loss.

Results and Discussion:

As in 2003, early attempts to positively identify *T. ostriniae* as the egg parasite being found in the treated vineyards via in-lab examination were unsuccessful when the parasitized eggs failed to hatch under the same lab conditions that have been successfully implemented with *T. ostriniae* in other crops. After trying different shipping/packing techniques we had a breakthrough in the last shipment in October when Hoffmann's lab was able to successfully hatch and identify *T. ostriniae* from a parasitized egg from the trial. Utilizing the new packing technique of encasing berries inside the bubbles of bubble wrap we hope to be able to make positive identifications with all shipments in 2005.

Although we were unable to positively identify *T. ostriniae* for the majority of the season, as in 2003 a look at egg parasitism between the paired blocks provides a good indication that the releases of *T. ostriniae* at the very least augmented naturally occurring biological control agents. As seen in Table 1., in all but two of treatment pairs (one slightly less with *T. ostriniae* and the other having no parasitism in either block) the *T. ostriniae* block had appreciably higher levels of egg parasitism than did the control block.

Berry damage due to grape berry moth was reduced in each of the nine *T. ostriniae* blocks as compared to the grower's conventional treatment. Although we were unable to

positively identify *T. ostriniae* from these blocks, a large increase GBM control in four of these blocks is another strong indication that continued work in this area has the potential to produce information useful in developing alternative grape berry moth management strategies for the future. Only 9 of the 10 blocks that started this project are included in the results. In the tenth vineyard black rot berry infections were so numerous that it left too few berries to rate for grape berry moth.

Table 1. Comparison of egg parasitism and average grape berry moth berry damage between blocks with *Trichogramma ostriniae* releases and control blocks managed with growers conventional practices.

Site	Treatment	Total eggs	Parasitized Eggs	% Parasitism	% Parasitism compared to T. ostriniae	Average % GBM Berry Damage/Cluster
Harborcreek	*T. ostriniae*	86	34	39.5		25.48
Harborcreek	Control	10	4	40	101.2	13.2
Westfield Lakeshore	*T. ostriniae*	8	4	50		8.0
Westfield Lakeshore	Control	9	3	33.3	66.6	52.2
Elvira 1	*T. ostriniae*	0	0	-		4.4
Elvira 1	Control	0	0	-	NA	5.1
Elvira 2	*T. ostriniae*	1	1	100		13.6
Elvira 2	Control	0	0	-	NA	3.2
Westfield South	*T. ostriniae*	8	4	50		8.0
Westfield South	Control	19	0	0	0	13.2
Westfield 1	*T. ostriniae*	0	1	0		10.6
Westfield 1	Control	0	0	0	0	11.9
Westfield Rt 5	*T. ostriniae*	3	3	100		18.5
Westfield Rt 5	Control	10	8	80	80	32.5
Westfield Niagara	*T. ostriniae*	3	1	33.3		11.3
Westfield Niagara	Control	2	0	0	0	30.3
Westfield Thruway	*T. ostriniae*	28	5	17.9		15.2
Westfield Thruway	Control	6	0	0	0	30.2

Again, only two of the three vineyards that started this project in the spring of 2003 were included in the results due to black rot berry infections resulting in too few berries to rate for parasitism (Table 2). With the development of appropriate packing techniques for shipment of berries with parasitized eggs we are hopeful that next year we will be able to positively identify the parasitoids found in the over wintering portion of this project.

Table 2. Percent parasitism in vineyards treated during only the 2003 growing season to determine over wintering potential of Trichogramma ostriniae in the Lake Erie region.

Site	Treatment	Total eggs	Parasitized eggs	% Parasitism
Rt 5 Westfield	*T. ostriniae* in 2003	28	0	0
Ripley	*T. ostriniae* in 2003	9	3	33.3

The Fredonia I and II vineyards are considered to be at extremely high risk for damage from grape berry moth and have had a minimal insect management program applied over the past 3-4 years (Table 3). The Fredonia/Brocton vineyard is also considered at high to extremely

high risk but is very well maintained and typically receives three insecticides aimed at grape berry moth each year. We will be looking at positive identification of the egg parasitoids involved in these vineyards in 2005.

Table 3. Rate of native parasitism in Lake Erie vineyards with no history of *Trichogramma sp.* applications.

Site	Treatment	Total eggs	Parasitized Eggs	% Parasitism
Fredonia/Brocton	None	12	0	0
Fredonia I	None	43	19	44.2
Fredonia II	None	30	11	36.7

Early season dispersal of *T. ostriniae* still needs to be studied to determine its effectiveness in building populations to combat late season grape berry moth damage (Table 4). This portion of the project was limited in the amount of samples that could be collected and examined during just prior to harvest due to manpower restrictions. This has been addressed for the 2005 growing season through the reduction in time requested for the field technician so student, or temporary, labor could provide the hands and eyes needed during the destructive sampling which is one of the busiest times for this project.

Table 4. Comparison of egg parasitism and average grape berry moth berry damage between blocks with two early season *Trichogramma ostriniae* releases and control blocks managed with growers conventional practices.

Site	Treatment	Total eggs	Parasitized Eggs	% Parasitism	% parasitism compared to T. ostriniae	Average % GBM Berry Damage/Cluster
Perrysburg Niagara	*T. ostriniae*	176	119	67.6		16.5
Perrysburg Niagara	Control	83	4	41	39.4	7.3
Portland I	*T. ostriniae*	7	3	42.9		4.6
Portland I (Camelot)	Control	5	0	0	0	6.0
Portland II	*T. ostriniae*	28	1	3.6		6.8
Portland II	Control	22	0	0	0	6.0

The *Trichogramma ostriniae* project was part of the Grape IPM display in the Grape Tent at Empire Farm Days, New York State's largest farm show this past summer and has been part of the discussions at the 2004 Great Lakes Fruit Workers meeting in Guelph, ON as well as numerous Coffee Pot and IPM Roundtable grower meetings held during the growing season along the Lake Erie Grape Belt.

Objective 2. Determine the economic loss potential from grape berry moth.

As in the 2003 results, it is apparent that damage from grape berry moth is responsible for a drop in berry size (Table 5). An average decrease of 31.85% is close to the 36.6% decrease found last year in GBM berries when compared to others in the cluster. For the second straight year there was also a decrease in the percent damaged berries and percent damage by weight as the collections moved from the wooded edge into the interior of the vineyard, as we would expect. However, traditional wisdom has always been that grape berry moth damage is concentrated in the first two post lengths or first six rows in a vineyard with damage dropping off dramatically after that. While we did see that in more of the vineyard blocks in 2004 than 2003

due to lower overall grape berry moth pressure this year, others did not follow this trend as shown by the averages by row (Table 5).

Table 5. Comparisons of variables to determine economic loss due to grape berry moth in the 2003 and 2004 growing seasons.

	% Decrease in Berry Size		% Damaged Berries	
Vine/Row	**2003**	**2004**	**2003**	**2004**
1	36.40	30.49	27.71	31.30
3	38.29	30.84	20.75	30.86
5	31.29	25.67	15.27	22.88
7	38.68	38.90	15.76	21.80
9	35.87	36.67	11.78	23.3
11	38.66	28.5	11.57	19.13
Average	**36.53**	**31.85**	**17.14**	**24.88**

Using the averages of percent decreases in berry size and percent damaged berries it is possible to determine how much loss potential there is from direct feeding. Combining results from 2003 and 2004 provides an average for berry damage from GBM of 21.02%. This amounts to 420.4 pounds per ton being affected through direct feeding by grape berry moth in the vineyard. The average of 34.19 percent decrease in berry size that comes from direct feeding can be put into the calculation to reveal that an average of 143.74 pounds of grapes were lost to grape berry moth feeding in project vineyards in 2003 and 2004. By plugging in the price per ton the grapes sell for into the calculations it is fairly easy to determine economic loss. At the low end of the scale $145 per ton grapes would result in a loss of $10.42 per ton.